UNITED PLANTERS' ASSOCIATION OF
SOUTHERN INDIA

SCIENTIFIC DEPARTMENT

(TEA SECTION)

ANNUAL
ADMINISTRATION REPORT

FOR

1953—1954

COMMONWEALTH
22 SEP 1954
AUSTRALIA

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THE ORIENTAL PRESS, COONOOR.

NOTE:

Specimens for laboratory examination should be sent by *unregistered* parcel post to

The Officer-in-Charge,
UPASI Tea Experiment Station,
Devarshola P. O.,
Nilgiris.

In the case of specimens too bulky to send by post, they should be sent by rail to Ootacamund and the Rail Receipts or Parcel Way Bills sent to

The Rajalakshmi Motor-Service,
Ootacamund,

for collection and forwarding to Devarshola.

UNITED PLANTERS' ASSOCIATION OF

With Compliments

Chief Scientific Officer,
United Planters' Association of S. India,
Scientific Department,
Glenview, Coonoor,
Nilgiris,
S. India.

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1953—1954

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Mr. S. Ananda Rau, m.sc.	*Asst. Scientific Officer & Entomologist*
Mr. V. Jayaraman, b.a., b.sc., (Ag.)	*Chemist*
Dr. K. S. Venkataramani, m.sc., ph.d., f.b.s.	*Botanist*

Junior Staff

Mr. E. P. Powell	*Field Recorder*
Mr. V. Raman (Resigned in July 1953)	*Clerk—Devarshola*
Mr. K. I. Abraham (appointed in July 1953)	*Clerk—Devarshola*
Mr. D. Arunachalam	*Clerk—Coonoor.*

Laboratory Attenders

Mr. Sankaran Nair
Mr. Madhavan Chetty

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United Planters' Association of Southern India

Annual Report of the UPASI Scientific Department

TEA SECTION

For 1st April 1953—31st March 1954.

REPORT OF THE CHIEF SCIENTIFIC OFFICER

PART I—ADMINISTRATION

The headquarters of the Chief Scientific Officer remained at "Glenview", Coonoor during this year. Mr. V. Raman, clerk at the Devarshola Experiment Station resigned his appointment on the 15th July 1953 and he was replaced by Mr. K. I. Abraham, formerly of the UPASI Labour Department at Coonoor.

There were no changes in the technical staff of the Department and the Assistant Scientific Officer continued to act as Officer-in-Charge, UPASI Experiment Station, Devarshola. The Chief Scientific Officer left Coonoor on furlough on the 17th October 1953 and returned after the completion of the year under review. During the absence of the Chief Scientific Officer on furlough in the United Kingdom, the Assistant Scientific Officer moved his headquarters to Coonoor and took charge of the Scientific Department. At this time Mr. V. Jayaraman acted as Officer-in-Charge, UPASI Experiment Station.

Once again the volume of advisory correspondence has increased throughout the year both in Coonoor and at Devarshola.

UPASI Tea Experiment Station, Devarshola: During the year under review a certain amount of tea in the Experiment Station area was uprooted. A block of poor tea of about one-third of an acre in the 1926 clearing was uprooted and the area fenced off and planted up as a demonstration plot of green manure plants and shade trees.

It was also decided to discontinue the 27 Plot Factorial Experiment as the condition of some of the plots had deteriorated to such an extent that valid data could no longer be obtained. Many of these plots were cleared and sown with green manure seed in preparation for replanting at some later date.

By virtue of these removals the planted area at Devarshola is now reduced to 13 acres, and the balance of 14 acres is made up of roads, buildings, fuel clearings, uncultivated areas, areas for replanting and areas under cultivation in crops other than tea.

During the year normal maintenance of the Laboratory and Store buildings, staff and labour accommodation, was undertaken. Sanction was obtained from the Tea Product Section Committee to install a water-supply scheme at a cost of approximately Rs. 10,000/-. A survey was conducted, the necessary materials ordered and the scheme will be put into operation during 1954.

Sanction was also obtained to construct a new 6 room labour line at a cost of about Rs. 10,000/- on a site adjacent to the old tea area. The Directors of Woodbriar Estate have very kindly agreed to make the necessary site of about 1/4th of an acre in extent available to the Experiment Station on the same terms and conditions as those laid down in the existing lease.

In the Annual Report for 1952–1953 the grave deficiency of rainfall during that year was commented upon. In the present year the rainfall was higher than for several years, 78.79 inches of rain being recorded. The South-West Monsoon rains had been particularly heavy and compensated in some considerable degree for the light North-East Monsoon rains received in the latter part of the year. Some welcome showers were to be had in March.

During the year 63,494 lb. of green leaf were harvested and sold to our landlords, Woodbriar Estate Limited, at a figure of 3 annas per pound, realising a sum of Rs. 11,905/2/-. Based on an average out-turn of 23 per cent. and on a reduced acreage, this quantity of green leaf represents a yield of 1,082 lb. of made tea per acre . This yield is considered most satisfactory. The monthly crop figures are given as an Appendix to this report.

Publications: A number of articles were published in the bi-monthly issues of *The Planters' Chronicle*, during the year and a new series of advisory leaflets was also introduced. These advisory leaflets appear in *The Planters' Chronicle* and copies are also sent to all member-estates. A list of publications by members of the Scientific Department Staff is given as an Appendix to this report.

Touring: During the year tours and liaison visits were paid to most estates in South India by members of the Scientific Department. A list of these tours is given in Appendix III.

During furlough in the United Kingdom the Chief Scientific Officer paid many visits to commercial and academic institutions with whom contact had been established during the past years. These visits included the Research Stations of F. W. Berk & Co. Ltd., at Tilgate, Shell Chemicals Ltd. at Sittingbourne, Plant Protection Ltd. at Fernhurst, Imperial Chemical Industries' Central Agricultural Control at Hawthorndale, Monsanto Chemicals Ltd. at Slough, Murphy Chemical Co. Ltd. at Wheathampstead, and Messrs. Boots Experiment Station at Nottingham. Offices of various chemical and machinery manufacturers were also visited including W. T. French & Son at Birmingham, Harry Ferguson Ltd. at Coventry, Allmans Ltd. at Chichester. Cooper Pegler Ltd at Burgess Hill, Drake & Fletcher Ltd. at Maidstone, Clean Crops Ltd. at London, Plant Protection Ltd. at Yalding and Pest Control Ltd. at Cambridge. On all occasions the Chief Scientific Officer met with the greatest courtesy, kindness, helpfulness and hospitality and his thanks are due to all who made these visits so pleasant and instructive.

Considerable help and advice was forthcoming from members of the staff of the Department of Agriculture, University of Oxford and the Agricultural Research Council Unit of Experimental Agronomy at Oxford. During his visit to Oxford the Chief Scientific Officer gave a research talk on research problems in Southern India to the staff of the Agricultural Research Council Unit of Experimental Agronomy and the staff of the University Department of Agriculture. A talk on the problems of mechanisation in the plantation industry in the Southern India was given to the staff and students of the Harry Ferguson, Massey Harris Training School at Coventry and to representatives of the managerial staff of Harry Ferguson and Massey Harris Ltd.

UPASI Scientific Conference and Exhibition. The Scientific Department exhibit during the annual exhibition showed the various stages carried out during a soil analysis. This exhibit aroused considerable interest.

The Scientific Conference this year contained 3 papers of general interest. A talk by Mr. Ian McTear, Resident Engineer, Indian Tea Association, Scientific Department, Tocklai, which dealt with problems of manufacture in Northern India, a review of the research policy of the Indian Coffee Board by Dr. B. T. Narayanan, B.A., PH.D., D.I.C., Director of Research, Indian Coffee Board, and a paper on pests and diseases of rubber in South India by K. N. Kaimal, B.A., Rubber Production Commissioner, Indian Rubber Board, were given and a discussion followed.

Second Annual Conference. The Second Annual Conference of the Scientific Department was held at "Glenview" on the 24th March 1954. It was attended by 7 delegates representing various South Indian District Planters' Associations and a number of visitors from among the planting community and commercial organisations connected with planting. Papers were presented by all members of the Scientific Department technical staff and a large number of questions submitted by the various District Planters' Associations were discussed. We were very pleased to welcome to this Conference Dr. R. J. McIlroy, Director, Indian Tea Association Scientific Department, Tocklai, who contributed a short talk. A full report of the proceedings has been published as UPASI Scientific Department Bulletin No. 12.

Boards and Committees. The Chief Scientific Officer continued to represent the Association on the Board of the Indian Council of Agricultural Research, Crops and Soils Wing, the Nilgiri District Soil Conservation Board and the Fertiliser Sub-Committee of the Indian Standards Institute. During his absence in the United Kingdom Mr. Ananda Rau attended meetings of the Nilgiri District Soil Conservation Board and the Biennial meeting of the Crops and Soils Wing of the Indian Council of Agricultural Research held this year in Bangalore. Mr. V. Jayaraman acted as alternate for the Chief Scientific Officer on the Fertiliser Sub-Committee of the Indian Standards Institute.

PART II—RESEARCH AND ADVISORY

Much of the work of the Department continues to centre on advisory problems and much of the time of the technical staff of the Department is, as always, occupied in dealing with advisory problems by correspondence.

The Blister Blight investigations carried out in previous years were followed up this year by a small scale experiment designed to test a number of newly developed commercial fungicides and additives under field conditions. These trials will be reported on more fully in this section. In the year under review the Entomology section became increasingly important with the increasing threat from Red Spider Mite and Purple Mite and the development of a Thrips problem in Central Travancore. The conclusion of the 27th Plot Factorial Experiment has meant that much attention has now to be given to the mass of experimental evidence which has accumulated over the last 12 years. This is receiving detailed study and results have formed the basis of talks given by the Soil Chemist and the Chief Scientific Officer. More critical examination however remains to be carried out before the full value can be derived from the experiment.

The work of the various sections is described in detail in the reports of the respective section heads and as the Chief Scientific Officer was absent for much of the period under review, little comment on these reports will be made in this section.

Of particular interest and potential value is the work described in the report of the Botanist dealing with measures for the control of soil-borne root disease fungi. The problems of root disease have to a large extent been over-shadowed in the past few years by Blister Blight and other pests and diseases, but it is nevertheless a fact that many of the enquiries received at the Experiment Station are concerned with attacks by root disease fungi and there are many areas in Southern India where these fungi constitute a considerable menace. Little has been achieved in the past in the control of soil-borne root disease fungi, although the problems have engaged the attention of research workers dealing with a variety of perennial crops. The development of new crop protection materials, however, has opened the way for different types of investigation and one hopes that in the not too distant future some method of controlling root disease fungi may be evolved. In this connection pilot work such as that carried out in the Mycology section of the UPASI Scientific Department is of considerable interest and fundamental value.

Blister Blight: During 1953 a number of fungicides were received for trial against Blister Blight of tea. These fungicides were screened during the course of a field trial lasting from August to December 1953. For the purpose of the trial a new technique was employed, plots consisting of single rows of bushes and each bush divided to receive two treatments. The resulting observations were carried out on these half-bush plots. The use of half-bushes reduces considerably the differences resulting from varying susceptibility to disease attack and reaction to fungicide applications on the part of individual bushes and if sufficient treatment replicates are available it is possible by using this method to reduce the plot size considerably.

The following fungicides were tested during the course of this trial:

		Concentration.
1.	Combacide	1 in 100
2.	I. C. I. 4% Cu dust (YF.3207)	
3.	I. C. I. 6% Cu. dust (YF.3105)	
4.	I. C. I. 6% Cu. dust (YF.3083)	
5.	Nirit	3 in 400
6.	Colloidal Copper	1 in 400
7.	Fernasul	1 in 40
8.	Perenox	1 in 400
9.	Perenox + Adhesive YF.2732	1 in 400 (each)
10.	Phemox	1 in 85
11.	Murvesco	1 in 128

The dusts were applied at the rate of approximately 13 lb. per acre and sprays were applied initially at rates of approximately 20 gallons per acre. At some stages of the trial however, due to nozzle wear, the application of spray fluid reached levels of approximately 40 gallons per acre.

Combacide supplied by the Combined Agencies Corporation, Washington, and Nirit supplied by Messrs. Farbwerke Hoechst through Fedco Limited, Bombay, are both organic fungicides and as is demonstrated in the trial failed to give any protection from the disease. Murvesco and Phemox are both mercury based fungicides, supplied by the Murphy Chemical Co. Ltd. and were included in the trial as an extention of investigations carried out in previous years. While on this occasion both these mercury fungicides gave adequate protection from the disease, in the case of Murvesco, severe phytotoxic properties resulted in considerable stunting of growth and bushes sprayed with this fungicide failed to flush freely. For this reason it is not possible to include the estimates of disease infection on Murvesco treated plots in this account, as the proportion of plant material was severely reduced- Phemox also caused some slight retardation of growth, but not to the same degree as in the case of Murvesco. There is some reason to believe that the stunting in the case of Murvesco and probably in the case of Phemox is due not to the mercury content of the fungicide but to the spreader employed in the formulation. Further investigations will be carried out to give positive information on these points.

The three copper dusts YF, 3207. YF.3083 and YF.3105 were supplied by Imperial Chemical Industries (India) Limited, Madras, who also supplied Fernasul, Perenox and the experimental adhesive YF. 2732. Colloidal Copper. a product of Philips Roxane, was supplied by Parry & Co. Ltd., Madras.

Table I shows the average percentage infection of shoot and third leaf for the various treatments over the whole period of the experiment.

TABLE I

Average % infection of shoot and third leaf

	Shoot infection %	Third leaf infection %
Control	27.2	33.95
Nirit	27.5	33.8
Combacide	32.3	42.45
Phemox	11.5	10.95
YF.3207 (4% Cu. dust)	18.05	17.85
YF.3083 (6% Cu. dust)	11.25	11.1
YF 3105 (6% Cu. dust)	8.15	4.45
Fernasul	10.8	10.05
Colloidal Copper	10.15	6.95
Perenox	9.95	8.8
Perenox + Adhesive YF.2732	9.9	6.0

For the purpose of interpreting this information a statistical technique whereby the figures are converted to another form, known as the Arc Sine transformation, has been employed. This technique is especially suitable for the examination of percentages in relation to fungicide trials and Table II shows the transformed figures for the various treatments.

TABLE II

Transformed figures of mean % infection.

	% Shoot infection	% Third leaf infection
Control	31.39	35.34
Nirit	31.62	35.55
Combacide	34.59	40.64
Phemox	19.82	19 35
YF.3207 (4% Cu. dust)	25.14	24.61
YF.3083 (6% Cu. dust)	19.28	19.34
YF.3105 (6% Cu. dust)	16.54	12.06
Fernasul	18.77	18.34
Colloidal Copper	18.58	15.29
Perenox	18.88	17.23
Perenox + Adhesive YF.2732	18.34	14.07

Significant differences 5% level—Shoot infection 1.45—Third leaf infection 3.13

Examination of the figures in Table II discloses that the various fungicides, Perenox with and without adhesive YF. 2732, Colloidal Copper, Fernasul and I.C.I. 6% dust YF.3105 have been extremely effective in controlling the disease. I. C. I. 6% dust YF.3083 and Phemox have been less effective. It is interesting to observe that while there is no significant difference between the control of shoot infection using either Perenox or Perenox + adhesive, the Perenox + adhesive mixture has been significantly more effective in reducing third leaf infection, indicating that the adhesive has had a positive effect in increasing the retention of Perenox on the leaf surface.

Of particular interest is the performance obtained using Colloidal Copper. This material contains only 15% metallic copper, less than one-third of the copper present in 50% wettable copper fungicides. Because, however, of the extreme fineness of particle size in the formulation and the ability of these colloidal compounds to remain in suspension for long periods, this material has been as effective as the standard 50% wettable copper fungicides. This is extremely important as materials of this nature might prove of considerable value, were mechanical methods of application to be developed in place of manual spraying and also in cases where high copper contents of made teas are to be avoided.

It is interesting to observe that Fernasual has proved as effective as the copper fungicides in controlling Blister Blight during this trial. However during the course of the trial some scorching of tender foliage was to be observed, suggesting that copper compounds may be preferable to lime-sulphur for the control of Blister Blight in tea nurseries.

ACKNOWLEDGEMENTS

Once again it is our pleasure and privilege to acknowledge the considerable assistance that we have received from all sections of the South Indian Planting Industry and in particular the Secretariat of UPASI and the Tea Product Section Committee.

I should like to take this opportunity of acknowledging the helpful cooperation of the Director and Staff of the Tea Research Institute of Ceylon, and the Director and the Staff of the Indian Tea Association, Scientific Department, Tocklai, during the past year. I should also like to acknowledge the cooperation of Agents and Managers of Estates in the conduct of field experiments and also those who have shown us all hospitality during the year.

PETER DE JONG,
Chief Scientific Officer.

METEOROLOGICAL

(1953—54)

Months	Rainfall in inches	No. of days with rain	Air		Soil*		Humidity.		Vapour Pressure.		Cloud.	
			Average noon maximum	Average overnight minimum	8:30 A. M.	3.00 P. M.	8.30 A. M.	3.00 P. M.	8.30 A. M.	3.00 P. M.	8.30 A. M.	3.00 P. M.
April 1953	5.86	13	83.3	65.0	80.1	85.8	88.2	66.6	22.8	22.6	4.3	6.3
May ,,	4.62	9	84.1	65.6	83.6	90.0	81.1	65.1	22.4	23.3	5.7	4.1
June ,,	12.62	20	76.7	65.1	77.1	81.2	91.2	86.4	22.7	24.4	6.6	6.8
July ,,	27.12	29	72.3	63.7	72.6	75.2	92.3	90.3	21.0	21.8	7.5	6.8
August ,,	14.36	26	74.4	64.0	72 8	75.4	92.5	81.7	21.2	22.5	7.3	5.3
September ,,	3.83	16	76.6	62.9	74.1	77.2	90.5	77.9	24.8	21.8	6.8	5.5
October ,,	6.66	21	76.9	64.1	74.7	77.9	92.9	84.7	22.5	23.6	4.9	4.6
November ,,	0.53	3	77.3	60.6	72.6	76.2	80.1	59.2	18.5	17.8	8.0	4.5
December ,,	—	—	77.6	58.3	72.2	75.5	85.0	47.4	17.2	14.6	5.5	4.0
January 1954	0.11	2	78.7	59.0	73.5	77.5	89.6	51.6	17.9	16.5	5.0	3.0
February ,,	0,61	2	83.7	59.8	75.3	80.2	80.7	38.0	17.0	13.9	5.0	—
March ,,	2.47	6	84.4	62.6	79.0	84.9	83.6	49.9	19.9	17.9	—	5.0
Total	78.79	147										

* at 1 foot depth.

Report of the Assistant Scientific Officer and Entomologist

(1953—1954).

Administration

The Assistant Scientific Officer was in charge of the Devarshola Station until the middle of October 1953, when he moved to Coonoor to act in the place of the Chief Scientific Officer who proceeded on furlough. He was stationed in Coonoor until the end of the year.

During the period of absence from Devarshola of the Assistant Scientific Officer, the Station was in charge of the Soil Chemist, Mr. V. Jayaraman.

Correspondence

The incoming and outgoing letters at the Station numbered 883 and 949 respectively. These included 334 technical enquiries dealt with during the year.

Touring

The touring carried out during the year is given in Appendix III. These were, as usual, for both investigation and advisory purposes.

Visitors

The Station received a fairly large number of visitors during the year. Representatives of Messrs. Imperial Chemical Industries Ltd., Shaw Wallace & Co, Ltd., Burmah-Shell, Bayers, Geigy Insecticides Ltd., Parry & Co., Ltd., and F.W. Berk & Co. Ltd., of England visited the Station from time to time and we had the pleasure of visits also from the Officers of the Madras Agricultural Department, the Central Rice Research Institute and the University of Mysore.

Publications

A paper reviewing the present position in regard to insect pests of tea in South India was contributed to the Second Annual Scientific Conference held in March 1954, the proceedings of which are to be published as Bulletin No. 12 of the Department.

ENTOMOLOGICAL

Advisory

As judged by the number and nature of entomological enquiries received during the year from the various districts, tea was generally free from any serious epidemic of insect pest. Helopeltis and Red Spider have continued to cause some concern and once again Thrips were reported to be on the increase.

In addition to examining specimens and suggesting the necessary treatment, the Department was also called upon to advise on the use on tea of various plant protection formulations available in the market.

Helopeltis

The situation regarding this pest has remained much the same as noted in the last annual report. The suspicion that the insect may be developing resistance to DDT is still being held in some quarters although no convincing proof of this is forthcoming. Having regard to the fact that DDT has been in use for 6 years, the possibility cannot be entirely overruled, but it is an extremely difficult point to prove except by close study and investigation on the spot, which the department has not yet been able to undertake. Most Estates are continuing to get adequate control with DDT and the possible resistance is therefore not viewed as a serious matter of immediate concern. It is nevertheless necessary to utter a word of caution against the use of too low concentrations of DDT and lower rates of application, as repeated applications of sub-lethal doses of the insecticide may well be a factor in inducing resistance in the insect.

Red Spider

The year under report witnessed a gradual increase of Red Spider in several districts and there is now a considerable body of evidence in support of the view that the increased use of copper fungicides and DDT has brought about an increase in the incidence of Red Spider.

In connection with the study of the problem of taint by the use of various acaricides in tea, work was devoted to developing a suitable technique for the small-scale manufacture of tea leaf samples. A miniature roller was constructed during the year and the leaf rolled in this machine and fired in the normal estate drier has been reported on favourably by the tasters. A miniature drier too has been made and is undergoing test. It is hoped that before very long the Department will be in a position to screen acaricides, of which there are large numbers of formulations awaiting trial, and assess their merits from the point of view of taint. At the same time, their efficiency in killing the mites is proposed to be determined with the ultimate object of selecting an acaricide which combines maximum efficiency with minimum risk of taint in made tea.

Purple Mite

Observations made during the year indicated that this mite is more widespread and causes far greater damage than Red Spider. On several estates in the Nilgiris, tea in its first year from pruning was noted to be particularly severely attacked and it is probable that this mite reaches injurious levels in other districts too.

The relationship between the increased use of copper fungicide and the increase of spider mites appears to hold good to a greater degree in the case of Purple Mite than with Red Spider. A case was noted during the year in which an Estate carrying out Cuprosana dusting against Blister Blight had a high incidence of Purple Mite whereas another neighbouring Estate, where no copper in any form had been applied, was practically free from this mite.

The necessity for treating large areas of tea is greater in the case of Purple Mite. As lime-sulphur and other wettable sulphur preparations impart a definite taint to tea, the choice of a suitable acaricide appears to be more urgent in dealing with Purple Mite.

Preliminary laboratory and field trials were carried out during the year with "Chlorocide", an acaricide kindly supplied by Messrs. Boots Pure Drug Co., Ltd. It was tried in three strengths, 0.04%, 0.1% and 0.2%, but all failed to produce a satisfactory kill of Purple Mite. Teas made from leaf harvested from bushes sprayed with Chlorocide at a strength of 0.15% active ingredient and on application rate of 1 lb. active ingredient per acre were reported on by tasters as tainted. These trials will be repeated in the coming year under conditions of greater control.

Thrips

Thrips continued to cause some concern during the year, especially in Central Travancore where a rapid build-up of the pest in the dry weather of 1953 was reported to have caused considerable damage to tea. In addition to loss of crop which has been variously estimated, depending on the severity of the pest, the damage is stated to result in a falling off in the quality of the made tea and in its poor appearance as a result of excessive stalk and fibre. From the Anamallais came another report of severe stunting of growth of plants in the nursery as a result of thrips attack.

From present indications, thrips have to be reckoned as a potentially dangerous pest which the tea industry may have seriously to contend with in future years. The study of the life-history and bionomics of the insect, which have not hitherto been investigated, have been taken on hand and possible control measures, both cultural and insecticidal, are receiving attention.

DDT, both in the form of wet spray and as dust, has given good control of the pest, but control with Dieldrin, a Shell product, is reported to be even better. The actual strength of the product necessary for effective control, the application rate per acre, the timing of applications and costs have yet to be worked out. At the same time, the toxic hazards, if any, in its use and the possibility of taint in made tea have also thoroughly to be investigated.

Eelworm

Reports of eelworm damage in tea nurseries were frequently received during the year. As control and ameliorative measures have frequently been mentioned in previous Annual Reports, it is needless to repeat them here. An unusual case which came to notice during the year was the occurrence of eelworm in a new tea clearing which accounted for the death of nearly 70% of the plants put out.

Minor Pests

Other minor pests which came in for report included the following:- Red Coffee Borer (*Zeuzera coffeae*,), Hepialid borer (*Phassus* sp.). Tea Aphis (*Toxoptera aurantii*) Tea leaf-miner (*Melanogromyza* sp.), flush-worm (*Cydia* (*Laspeyresia*) *leucostoma*), a looper (unidentified), scale-insects, termites and grasshoppers in tea and a weevil (*Myllocerus viridanus*) on Dadap.

Systemic Insecticides

A preliminary trial with the primary object of determining the possible toxic hazards in the use of systemic insecticides in tea was carried out during the year, using materials kindly supplied by Messrs. Pest Control Ltd., England.

Small plots of tea, each of 20 bushes, were sprayed or otherwise treated with the following formulations, at the concentration noted against them.

N. C. 7-20% a. i.	...	0.1%
Pestox 3 H	...	0.2%
CR 686 A-50% a. i.	...	0.05%
Hannane 50% a i.	...	0.2%
Hannane capsules (6 gm.)	...	2 for 3 bushes.

Three plots were devoted to each treatment, one to be plucked 10 days after treatment, another after 15 days and the third after 20 days. The first three formulations were sprayed at a rate equivalent to 62.5 gallons per acre and Hannane 50% a. i. was applied to the soil at the rate of 1000 cc. per bush. Hannane capsules were broken and the contents equally distributed into two holes, 6" deep, made one on either side of the main stem of the bush.

The leaf harvested 10, 15 and 20 days after treatment was withered and dried in the oven and samples were sent to Messrs. Pest Control Ltd., for analysis. The results are awaited.

Acknowledgments

Grateful acknowledgments are made to the Managers of Estates who have rendered assistance in the conduct of field experiments and in various other ways.

It is once again a pleasure to record appreciation of the hospitality received from Managers of Estates visited during the year.

S. Ananda Rau,
Assistant Scientific Officer and Entomologist.

Report of the Soil Chemist

(1953—1954).

Advisory

The following samples were analysed and reported on during the year, in connection with advisory and research work.

Soils	155
Manures and manure mixtures	38
Fungicides & Insecticides	32
Copper content in dusted rubber and tea leaf samples	51
Miscellaneous (Compost, Lime, Wattle bark, Tea waste, Coffee husk, etc.)	11

In addition to the above analyses, 51 enquiries were attended to. The majority of these related to the various aspects of manuring of tea.

Publications

A paper entitled "Some Aspects of Tea Manuring" was contributed to the Scientific Conference held in March 1954.

Manures

All the manures and manure mixture samples sent for analysis conformed to the guarantee given by the suppliers.

The small scale trial to study the extent of absorption of moisture by manure mixtures containing various percentages of urea was completed during the year. Details of the results obtained are given in the paper contributed to the Scientific Conference. It appears from the figures obtained that it would not be desirable to include more than 20% by weight of urea in manure mixtures and that in general 15% would be the safe upper limit.

Another aspect of manuring, dealt with in the above paper, is the availability of nitrogen in ground-nut cake Laboratory trials show that nearly 60% of the nitrogen in ground-nut cake becomes available during the course of four weeks, thereby disproving the general assumption that ground-nut cake is a slow acting manure.

The important role played by potash in the manuring of tea has been clearly brought out by the Factorial Experiment on the Station which was initiated in 1940 and concluded during 1953. The effect of potash on plant population and soil organic matter and nitrogen has been given in detail in the paper contributed to the Conference. Potash-starved bushes die out gradually, the death being hastened during years experiencing prolonged droughts. Consequently, the soil is exposed resulting in depletion of organic matter and nitrogen. From the point of view of maintaining the health of the bushes and the general fertility of the soil, it is essential to include potash in tea manure mixtures.

Soils :

A large number of the samples analysed were from prospective nursery sites.

Several samples of soil were also received for analysis from areas carrying good and poor stands of tea, to determine the causes of the difference in growth. Analysis of these samples failed to reveal any analytical differences. It is necessary to point out that routine and complete analysis of soils from such areas has a very restricted value and other aspects like shade, facing of the field, nature of sub-soil etc. have to be looked into.

It was reported from one estate that tea in a new clearing area was not coming up well and that there were vacancies amounting to nearly 60%. Determination of pH reaction) value showed that the soil was almost neutral in reaction and thus not suitable for tea.

Complete analysis of six soil samples intended to be used for vegetative propagation of tea was carried out during the year.

General :

The determination of the copper content of dusted rubber leaf samples was made in connection with the investigation of leaf-fall in rubber by the Botanist. The dusted tea leaf samples were analysed in connection with the investigation of formulations of copper fungicide with locally obtained filler.

It is necessary to point out that fungicides, when not in use, should be properly stored in air-tight containers. If this is not done deterioration sets in, resulting in poor suspension values.

Blister Blight :

Cooperated with the Asst. Tea Scientific Officer and Botanist in the screening trial of different fungicides. Details of the trial are given in a separate section in this report.

Field Experiments :

The yield data for the field experiments are tabulated below :

A. 27 plot (3 x 3 x 3) Factorial Experiment.

The Experiment Station. The yield figures for the first year of the fifth cycle are as follows :—

TABLE 1

Nitrogen	0 lbs.	40 lbs.	80 lbs.
Yield	505.5	511.5	698.7 lbs. made tea acre
Phos. acid	0 lbs.	20 lbs.	40 lbs.
Yield	566.1	569.1	580.5 lbs. ,, ,, ,,
Potash	0 lbs.	20 lbs.	40 lbs.
Yield	289.8	572.7	853.2 lbs. ,, ,, ,,

Difference required for significance :

P = .05 = 201.7 lbs. made tea

P = .01 = 305.6 „ „ „

The increase due to 80 lbs. nitrogen falls short of significance.

Phosphoric acid has not shown any effect on yield throughout the duration of the experiment.

Both the single and double dose of potash have continued to give significant increases, the former at 5% level and the latter at 1% level.

It has been decided to discontinue this trial, keeping however certain selected plots under observation to study the effect of continued omission of phosphoric acid and the effect of ceasing to manure.

B. 25 Plot (5 x 5 Randomised Block) Experiment.

High Range (Kanniamallay, Munnar, Letchmi and Nullatanni)

TABLE 2

Yields in lbs. Made Tea per acre

	O	N	NP	NK	NPK
Nullatanni	312.1	450.9	477.9	415.3	530.3
Munnar	1144.3	1293.3	1265.8	1314.9	1294.9
Kanniamallay	1353.8	1567.6	1446.1	1515.2	1510.9
Letchmi	341.3	316.4	283.0	365.0	578.3

(Critical difference P = .05 = 127.9 lbs. made tea per acre).

The differences between the treatments are not significant on the first three estates. On Letchmi, the NPK treatment has significantly increased the yield over no treatment.

C. 24 Plot (3 x 8 Randomised Block) Experiment.

Nilgiris : Korakundah. The nitrogen in the form of ammonium sulphate was applied during April 1953. The bushes were pruned during December 1953. The yield figures from April to December are as follows :—

TABLE 3

Nitrogen	0 lbs.	40 lbs.	80 lbs.
Yield	699	700	738 lbs. made tea/acre

The differences between the treatments are not significant. Even when the yields are corrected for plant population and preliminary yields, by analysis of covariance, the differences are still not significant.

D. 25 Plot (5 x 5 Randomised Block) Experiment.

Nilgiri-Wynaad: Rockwood. The manure application was made during April 1953. The yield data for the period April 1953—March 1954 are given below. These yields have been adjusted to the plant population by analysis of covariance.

TABLE 4

No manure	N	NP	NK	NPK	
708.8	740.3	775.6	814.6	836.6	lbs. made tea/acre.

Except for nitrogen alone, the other treatments have significantly increased the yield over 'No manure'.

E. Soil Amendment Trials.

The application of NPK mixture was made during the last week of April on Mayfield and Daverashola Estates. The following are the yield data for the period May 1953—April 1954.

TABLE 5

Yields in lbs. Made Tea per acre

	No manure	Ammonium Sulphate	Amendment	NPK	Amendment +NPK	C D P = .05
Mayfield (May 1953/ April 1954)	607.5	——	657.8	1001.7	1034.3	125.0
Daverashola (May 1953/ April 1954)	950.6	1294.1	966.2	1254.6	1275.2	200.0
Craigmore (March 1953/ February 1954)	881.1	——	893.0	1121.4	1094.0	100.4

This year, the corrective amendment alone has slightly increased the yield over 'No manure' on all the estates, though not significantly so. NPK mixture either alone or with corrective amendment has again given significantly higher yields than 'No manure' but the addition of amendment to the NPK mixture has not affected significantly the yield. On Daverashola, nitrogen alone has resulted in a significant increase over 'No manure.'

F. Manuring of Young Tea.

This experiment was continued, but so far there is no difference in the growth measurements between the treatments.

Acknowledgement:

Grateful acknowledgements are due to Managers of estates visited for assistance received. Thanks are due to Mr. V. Raman, who, till the time of his resignation, gave valuable help in chemical analysis.

V. JAYARAMAN,
Soil Chemist.

REPORT OF THE BOTANIST

(1953—1954).

General

As usual, advisory work continued to be the main feature of activity of this department during the year under review. One hundred and twenty-eight technical enquiries of botanical and phytopathological interest were answered. A general classification of the enquiries is as follows:

Subject	No. of enquiries.
Tea	71
Rubber	8
Coffee	4
Plant Identifications	20
Weeds shade, green manures, etc.	25

Amongst the enquiries on tea, those on root diseases numbered a little over 50 per cent. An analysis of the enquiries on tea problems is given below :

Root disease	36
Stem disease	8
Leaf disease	7
Physiological aspects	16
Seed testing	1
Vegetative propagation	1
Fungicides	2

In view of the large number of queries received on root diseases, this subject was chosen for discussion at the Second Annual Scientific Conference and the Botanist contributed a paper entitled "The Principles of Tea Root Disease Control".

TEA.

Leaf Diseases

Barring Blister Blight (*Exobasidium vexans*), no other leaf disease was noticed on any appreciable scale to deserve special mention in this report.

A screening trial of fungicides was conducted and a number of formulations, including those based on copper and mercury and two organic fungicides were tested against Blister Blight. Details of the trial are reported elsewhere.

Stem Diseases

No stem disease of importance was recorded from any of the districts. Branch canker caused by the fungus *Macrophoma theicola* was the one most commonly reported from a number of estates. There appears to be some relation between prolonged droughts and infection by this pathogen, but the exact relationship has yet to be understood. The fungus was also noticed as a wound parasite on branches damaged by sun-scorch.

Collar-rot was another disorder that had caused considerable damage to young tea plants. No micro-organism was consistently found associated with the damaged tissues, although odd instances of infection by a *Fusarium* sp. and *Rhizoctonia bataticola* were observed. These organisms were considered to be of secondary importance, the primary cause of the trouble experienced being the over-heating of the exposed soil resulting in scorching and death of the tissues at the ground level or a little above it.

Root Diseases

Reports of root diseases were received from almost all the districts. Brown Root Disease (*Fomes noxious*) and Red Root Disease (*Poria hypolateritia*) were the two most frequently reported. Black Root Rot (*Rosellinia arcuata*) was recorded from a high-elevation estate on the Nilgiris and Cylindrocladium disease, a secondary disease, was noticed on a few young tea plants received from an estate in the Nilgiri-Wynaad.

Effect of soil Fumigants on Root-Infecting Fungi

A laboratory trial was undertaken to test the effect of Shell DD soil fumigant and Chlorobromopropene (CBP.55), both kindly supplied by Messrs. Burmah Shell Ltd., on three of the root-infecting fungi, viz., *Fomes noxius*, *Armillaria mellea*, and *Cylindrocladium* sp. The test is being repeated to confirm the results obtained, and as the preliminary findings are of some interest they are now presented here.

A. In pure culture on agar plates :

Potato-glucose or asparagin-glucose agar was used as the medium for growth. For the DD treatment, the dishes were kept in a chamber of 2 litre capacity in which was placed a small vial containing 0.5 ml. of the fumigant. Inocula of 4 mm. diameter were employed in all the experiments and the data furnished below are averages of figures obtained from three dishes.

1. FOMES NOXIUS :

	Growth in mm. (diameter of colony) on potato-glucose agar in		
	24 hrs.	40 hrs.	64 hrs.
Control	5.4	13.7	26.7
Kept in DD chamber continuously	0	0	0
Kept in DD chamber for 24 hrs. and then removed outside	0	0	0

2. CYLINDROCLADIUM sp. :

(a) Effect of Shell D D soil fumigant on the growth of the fungus.

	Growth in mm. (diameter of colony) on potato-glucose agar in					
	24	40	48	64	96	140 hours.
Control	10.3	18.7	21.7	28.3	39.3	53.3
In DD atmosphere	0	0	0	0	0	0

(b) Growth of the fungus after being kept in the DD chamber for different periods.

No. of hours in DD atmosphere.	Growth in mm. on asparagin-glucose agar after 24	48	72 hours.
0	8	18	27
2	7	18	27
4	7	15	25
6	7	15	25
8	6	15	23
12	slight	12	21
14	nil	12	21
16	,,	11	20
18	,,	11	20
20	,,	7	14
22	,,	6	14
24	,,	6	13

3. ARMILLARIA MELLEA :

	Growth in mm. on potato-glucose agar after 144 hours.	
	Mycelium	Rhizomorph (longest)
Control	8	20
In DD atmosphere	0	0
In DD chamber for 24 hrs. and then removed outside	0	0

In the control dish, the rhizomorph grew far ahead of the free mycelial growth on the agar and this shows that the rhizomorph is an important organ for the translocation of food reserves from the 'food-base' to the plant tissue that is being invaded by the fungus.

The above data indicate that, in pure culture, the DD soil fumigant has a marked depressive effect on the growth of the fungi tested.

B. Effect on Fomes noxius established within tea roots and buried in soil:

Small tea roots (roughly 1" long and 0. 25" in diameter) artificially inoculated with *Fomes noxius* were buried in soil (sterilized and unsterilized) taken in small covered glass jars The soil in some of the jars was fumigated with the DD fumigant (0.06 ml. per jar, i. e. approximately 7 ml. per c. ft) and in the others it was left untreated. The soil surface was lightly wetted with sterile water and then the jars were left covered with their lids Root bits from the jars were plated out on potato-glucose agar one month after the initiation of the experiment.

Fomes noxius could be isolated from the root bits buried in the unsterilized untreated soil, although the cultures in some cases were contaminated. The majority of the roots from the unsterilized fumigated soil yielded such fungi as *Trichoderma viride* and species of *Fusarium* and *Penicillium* but not *Fomes noxius*. *Trichoderma viride* was isolated either alone or in association with other fungi from seven out of the ten roots plated out from the unsterilized fumigated soil.

Nine out of the ten roots taken from the sterilized untreated soil yielded *Fomes noxius* and in one case the plate was contaminated. Similarly, the fungus could be isolated from eight roots taken out of the sterilized fumigated soil, while the remaining two roots did not yield any fungus.

The preliminary findings show that the fumigant is capable of arresting the the growth of these fungi in pure culture and that it has practically no direct effect on the fungus ensconced within the roots buried in the soil. In the unsterilized soil the fumigant appears to have a partial sterilization effect encouraging the growth of certain fungi, chiefly *Trichoderma viride*, a common inhabitant of these soils and which is apparently unaffected by the fumigant at the rate at which it is tried.

Trichoderma viride is seen to invade the buried roots more quickly in the fumigated soil than in the untreated one and inhibit the growth of the fungus primarily established within the root tissue. If these tentative findings are confirmed by further trials the question of eradicating root-disease fungi in badly infected patches in the field by means of soil fumigation may then be considered. Further laboratory trials are planted for the coming year with CBP. 55, a more potent soil fumigant which appears to kill pure cultures of some of the root infecting fungi in a shorter time than Shell DD.

MISCELLANEOUS

Green Manures:

Attempts were made to establish various green manure crops on small demonstration plots at the Experiment Station. The following species were grown: *Crotalaria anagyroides*, *C. agatiflora*, *C. Grahamiana*, *C. juncea*, *C. lanata*, *C. laburnifolia*, *C. spectabilis*, *C. striata*, *C. usaramoensis*, *Tephrosia candida*, *T. Vogelii*, *Lupinus sp.*, *Sesbania cinceriscens*, *S. speciosa*, *Desmodium ovalifolium*, *D. distortum* and *Stylosanthes gracilis*. A note on *Crotalaria anagyroides* was published in the Planters' Chronicle and descriptions of the other species are being compiled.

Rubber:

On behalf of Messrs. Peirce, Leslie & Co., an investigation was undertaken on the abnormal leaf-fall caused by *Phytophthora palmivora* in the Mooply Valley, Cochin,

during June-July 1953. The life-history of the causal organism was first studied in detail and McRae's findings were confirmed. A preliminary study was also made of the possibility of controlling the disease by dusting with copper-based fungicides. A summary of the work is given below.

The fungus starts its activity after the dry season and just before the onset of the S.W.Monsoon at a few points on the estate, chiefly from dormant hyphae lodged in dead tissues. The fruits get easily infected and serve as the main propagating centres. Quick and abundant development of sporangia take place in a saturated atmosphere and with the onset of the monsoon a relative humidity of well over 85% is obtained and conditions become favourable for the rapid development of the organism. Sporangia are formed in numbers on aerial hyphae on the infected fruits in a very short time. The production of sporangia and the discharge of their zoospores can take place within 24 hours. Sporangia and zoospores are not borne in dry air and wind-blown rain is a major factor in the rapid spread of the disease. During the early part of the monsoon opportunities exist for continuous distribution and rapid spread of the disease.

Adequate protection against leaf-fall may be secured by judicious application of free-flowing copper-based fungicidal dusts. The important consideration in dusting is the proper timing of the fungicidal application; dusting should be postponed to as near the monsoon as possible. It is difficult to suggest exact dates for dusting as it depends on the prevailing weather conditions. When the premonsoon rains in May are heavy and continuous and tend to merge with the monsoon as in some years, the first round of dusting may have to be done early, say, when there is a break after 5 or 6 days of continuous rain and the whole atmosphere is muggy. It is possible to carrry out dusting on days with drizzle or light rain giving a proper coverage of dust, but heavy rains immediately after dusting wash the dust off the foliage. A pilot trial conducted on a field of about 40 acres with Cuprosana 6% dust applied at the rate of 16 lb. per acre per round shows that satisfactory control of the leaf-fall can be achieved with three applications of dust properly timed.

Acknowledgements:

I am thankful to the Managers of the estates visited during the year for the assistance and hospitality received, in particular to Mr, J. M. Mortimer of the Chemoni Valley Estate for the facilities provided during my two-month stay on the estate in connection with an investigation on the abnormal leaf-fall of rubber, financed by Messrs. Peirce, Leslie & Co. All the information and help willingly given by Messrs. T- S. Ramakrishnan and C. S. Krishnaswami of the Agricultural Research Institute, Coimbatore, and Prof. T. S. Sadasivan of the University of Madras are greatly appreciated and gratefully acknowledged.

K. S. Venkataramani
Botanist.

APPENDIX I.

Monthly Crop Statement in lbs. green leaf

Tea Experiment Station, Devarshola.

	1949/1950	1950/1951	1951/1952	1952/1953	1953/1954
April	3,544	2,016	2,681	3,662	3,662
May	6,098	1,678	11,323	4,358	11,077
June	5,005	2,238	6,482	6,875	6,149
July	7,291	9,994	7,567	6,048	6,965
August	5,887	3,843	6,222	10,134	6,320
September	4,546	4,611	7,442	4,837	7,508
October	5,566	4,635	8,782	10,662	8,295
November	4,393	4,867	5,237	3,527	4,602
December	2,113	2,875	2,399	3,279	2,651
January	1,434	2,846	2,593	2,240	1,909
February	1,615	1,839	2,495	1,711	1,548
March	2,312	1,882	3,450	1,705	2,808
	49,804	43,324	66,673	59,038	63,494

APPENDIX II

List of Publications of the Scientific Dept., for the year 1953–54.

1. "Investigations into the use of certain materials for the lining of tea chests", by Peter de Jong. (*Planters' Chronicle* Vol. XLVIII, No. 10, pp. 241-242).

2. "Notes on some common Crotalarias—*I. Crotalaria anagyroides*" by K. S. Venkataramani. (*Planters' Chronicle* Vol. XLVIII.)

3. UPASI Scientific Department Advisory Leaflet No. 1—"How to send plant specimens for examination" by K. S. Venkataramani. (*Planters' Chronicle* Vol. XLVIII, No. 14, pp. 351-352).

4. UPASI Scientific Department Advisory Leaflet No. 2—"Methods of sampling soils and manures for analysis" by V. Jayaraman. (*Planters' Chronicle* Vol. XLVIII, No. 14, pp. 352-353).

5. "Research on Tea in South India" by Peter de Jong. (*Planters' Chronicle* Vol. XLVIII, No. 16. pp. 434-435).

6. UPASI Scientific Department Advisory Leaflet No. 3—"Copper Fungicides for the control of fungus diseases of tea" by Peter de Jong. (*Planters' Chronicle* Vol. XLVIII, No. 18, p. 482).

7. "Men, Meat and Machinery" by Peter de Jong. (*Planters' Chronicle* Vol. XLIX, No. 1, pp. 3-5).

8. "Recent Developments in the control of Blister Blight of tea in South India" by Peter de Jong. (*Plant Protection Overseas Review*, Vol. IV, No. 2).

APPENDIX III.

List of Tours by Officers of the Scientific Department.

April 1953	Chief Scientific Officer	Singampatti & South Travancore.
April 1953	Asst. Scientific Officer	Terrace Estate.
May 1953	Chief Scientific Officer and Asst. Scientific Officer	Mysore, Coorg and Wynaad P. As.
June/July 1953	Botanist	Chemoni Valley Estate, Cochin (Rubber leaf-fall investigation.)
July/Aug. 1953	Asst. Scientific Officer	Thiashola & Korakundah Estates, Nilgiris.
December 1953	Asst. Scientific Officer	Prospect Estate, Nilgiris.
January 1954	Asst. Scientific Officer	Indian Science Congress, Hyderabad.
February 1954	Asst. Scientific Officer	Pachaikadu, Sutton and Katary Estates, Nilgiris.
March 1954	Asst. Scientific Officer	Moutere, Sutton, Terrace, Nonsuch and Terramia Estates, Nilgiris.